

299-W18-184 (A7666) Log Data Report

Borehole Information:

Borehole: 299-W18-184 (A7666)			Site: 216-Z-12 Crib			
Coordinates (WA St Plane)		GWL¹ (ft): None		GWL Date: 02/08/06		
North (m)	East (m)	Drill Date	Ground Level Elevation	Total Depth (ft)	Type	
135458.268	566360.587	05/80	687.21	32.0	Cable	

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel	2.4	6 5/8	6 1/16	9/32	+2.4	32

Borehole Notes:

The logging engineer measured the casing stick-up and diameter using a caliper and steel tape. Logging data acquisition is referenced to the TOC.

Logging Equipment Information:

Logging System: Gamma 1E		Type: SGLS (70%) SN: 34TP0587A	
Effective Calibration Date:	01/10/06	Calibration Reference: DOE-EM/GJ1106-2006	
		Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 Repeat	3 Repeat		
Date	02/08/06	02/08/06	02/13/06		
Logging Engineer	Spatz	Spatz	Spatz		
Start Depth (ft)	32.0	32.0	28.0		
Finish Depth (ft)	3.0	27.0	18.0		
Count Time (sec)	100	400	400		
Live/Real	R	R	R		
Shield (Y/N)	N	N	N		
MSA Interval (ft)	1.0	0.5	0.5		
ft/min	N/A ²	N/A	N/A		
Pre-Verification	AE158CAB	AE158CAB	AE160CAB		
Start File	AE158000	AE158030	AE160000		
Finish File	AE158029	AE158040	AE160020		
Post-Verification	AE158CAA	AE158CAA	AE160CAA		
Depth Return Error	- 1	- 1	0		

Log Run	1	2 Repeat	3 Repeat		
(in.)					
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.		

Logging Operation Notes:

Logging was conducted with a centralizer on the sonde and measurements are referenced to top of casing. Repeat data were acquired at 400 second counting time at 0.5 ft intervals to provide additional detail of the highest activity zone.

Analysis Notes:

Analyst:	Henwood	Date:	07/10/06	Reference:	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications for the SGLS were performed before and after each day's data acquisition. The acceptance criteria were met.

A casing correction for 9/32-in.-thick casing was applied throughout the borehole.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G1EJan06.xls using an efficiency function and corrections for casing and dead time as determined from annual calibrations.

Results and Interpretations:

²⁴¹Am is detected at 21, 24, and 25 ft; repeat data acquired at 400 second counting times indicate ²⁴¹Am almost continuously from 19 to 26 ft. Note: The repeat section data are considered in the discussion of each radionuclide below. The maximum concentration is measured at approximately 159,000 pCi/g at 25 ft. ¹³⁷Cs emits a 661.66 gamma ray that cannot be distinguished from a 662.40 gamma ray emitted from ²⁴¹Am. A corroborating energy peak at 722.01 keV is used to establish the presence of ²⁴¹Am rather than ¹³⁷Cs. In this borehole the 722.01 keV energy peak is used to determine the ²⁴¹Am concentration. It is interpreted that ¹³⁷Cs is not present in this borehole in any significant quantities.

²³⁷Np is detected with the SGLS by measuring a daughter product (protactinium-233 (²³³Pa)) that emits relatively prominent gamma rays at energy peaks of 300.34, 312.17, 340.81, 375.45, 398.62, and 415.76 keV. The 312.17 keV gamma line exhibits the highest yield (38.6 %) and is used to determine the concentration for ²³³Pa. ²³³Pa was detected between 22 and 32 ft. The maximum concentration is 43 pCi/g at 25.5 ft in depth.

²³⁹Pu is detected between 22.5 and 26.5 ft. The maximum concentration is measured at approximately 182,000 pCi/g at a 24.5 ft depth. An evaluation of ²³⁹Pu energy peaks determined the 375.05 energy peak had no significant interferences and is used to calculate concentrations.

Weapons grade plutonium is generally considered to be in approximate proportions of 94% ²³⁹Pu, 6% ²⁴⁰Pu, and 0.005% ²⁴¹Pu. Using these proportions, ²⁴⁰Pu could be expected to be on the order of 11,000 pCi/g and ²⁴¹Pu at 900 pCi/g. No direct assay of ²⁴⁰Pu and ²⁴¹Pu is possible with the SGLS in this borehole.

A slightly elevated ²³²Th concentration as determined using the 2615 keV (²⁰⁸Tl) energy peak is indicated between 23.5 and 27 ft. The plot of natural gamma logs shows the disruption of the equilibrium of the natural ²³²Th decay, where between 23.5 and 27 ft the ²²⁸Ac indicates ²³²Th concentrations below that calculated from the 2615 keV gamma line. This difference is attributed to the existence of ²³²U. To determine the concentration of ²³²U, the activity due to natural decay of ²³²Th, must be subtracted. The

^{228}Ac concentration is subtracted from the ^{232}Th concentration calculated based on the 2615 keV ^{208}Tl energy peak. The result is a maximum concentration of approximately 0.13 pCi/g ^{232}U . For the naturally occurring ^{232}Th , the 2615 keV peak is used to calculate concentrations except for the interval from 23.5 to 27 ft where ^{228}Ac is used.

^{233}U almost certainly exists where ^{232}U is detected. In a reactor using thorium target material, ^{233}U will be generated at roughly three orders of magnitude more than ^{232}U . However, at relatively low concentrations, ^{233}U does not emit a gamma ray that can be detected with the SGLS. Decay products that potentially could be measured, have not had sufficient time to grow into equilibrium with their parent so that detection is possible. It is inferred on the basis of the ^{232}U concentration that less than 100 pCi/g ^{233}U may exist in this waste stream.

Spectral gamma data were acquired in this borehole in 1993 by Westinghouse Hanford Company using the Radionuclide Logging System (RLS). A comparison plot of the RLS (1993) and SGLS (2006) manmade radionuclides show similar concentrations for ^{233}Pa . However, ^{241}Am and ^{239}Pu concentrations are significantly different. It is suspected the RLS utilized a less efficient detector (18 % HpGe) and less counting time that resulted in marginal detections very near the MDLs. It is also believed the RLS detections of ^{137}Cs near 1 pCi/g were erroneous and actually reflect ^{241}Am . Data analysis for the 1993 data did not identify ^{232}U or ^{233}U as potential contaminants.

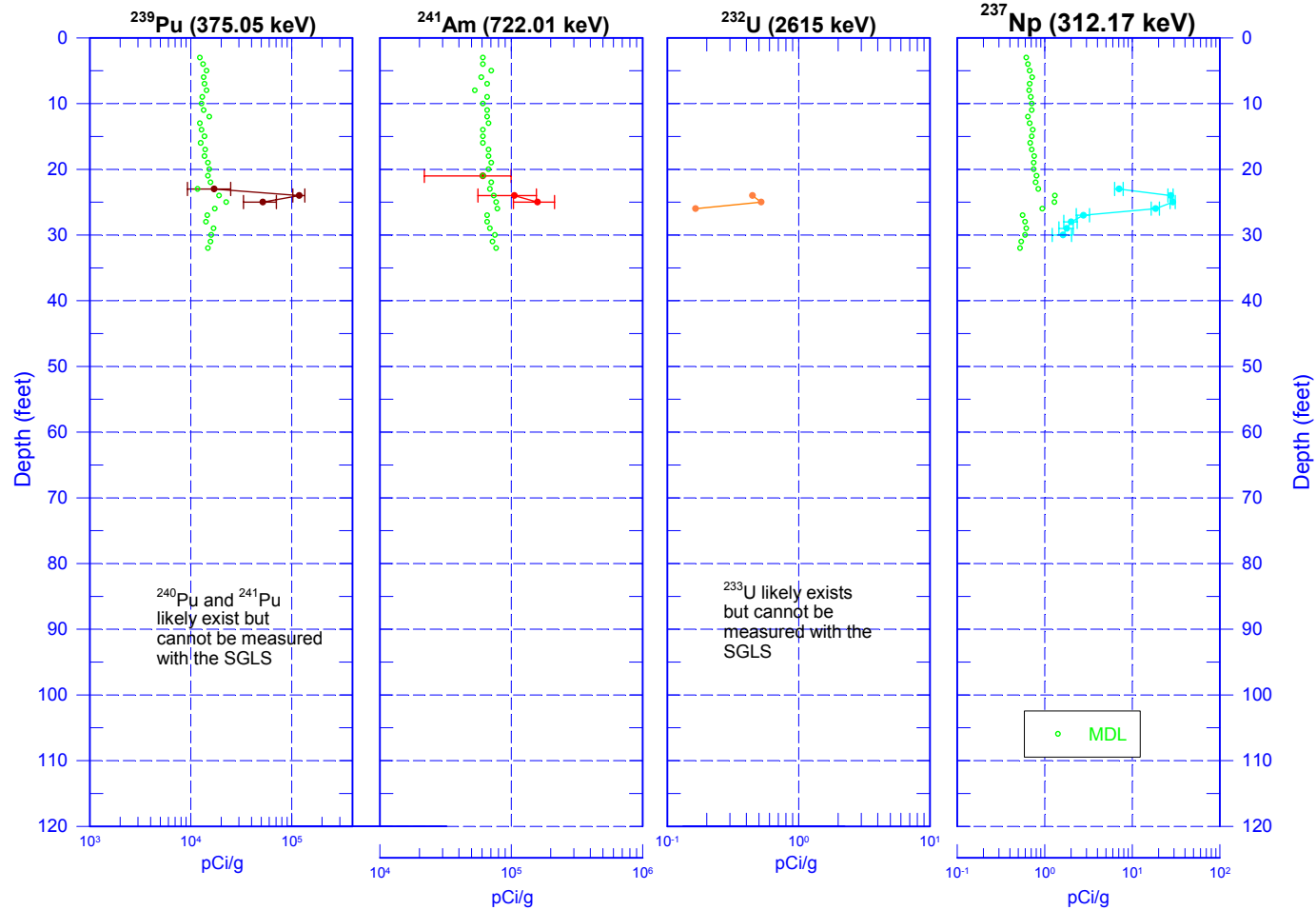
List of Log Plots:

Man-Made Radionuclide Plot
Natural Gamma Logs
Combination Plot
Total Gamma & Dead Time
SGLS/ RLS Comparison Plot
Repeat of Man-made Radionuclides
Repeat Section of Natural Gamma Logs

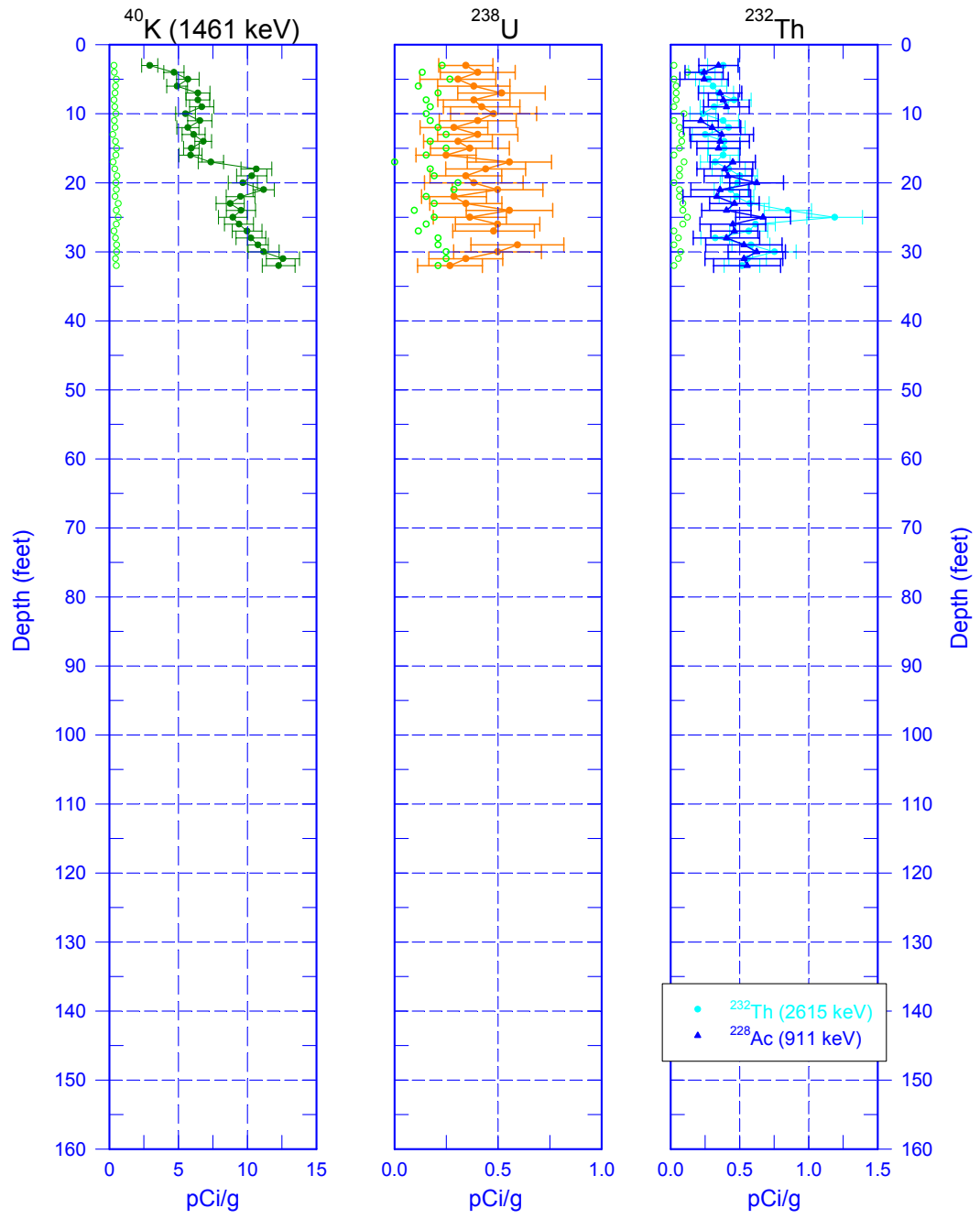
¹ GWL – groundwater level

² N/A – not applicable

299-W18-184 (A7666) Man-made Radionuclide Plot

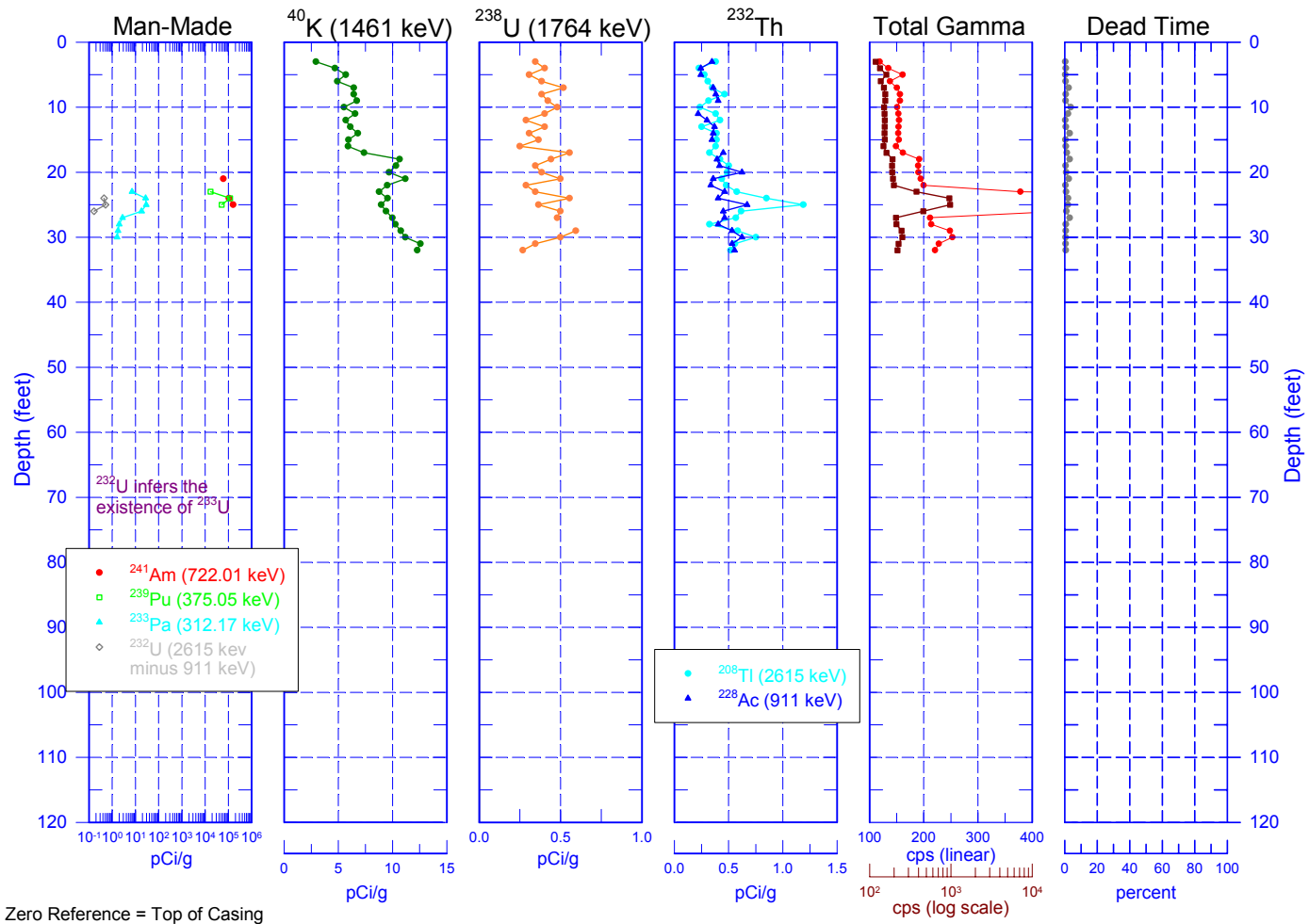


299-W18-184 (A7666) Natural Gamma Logs



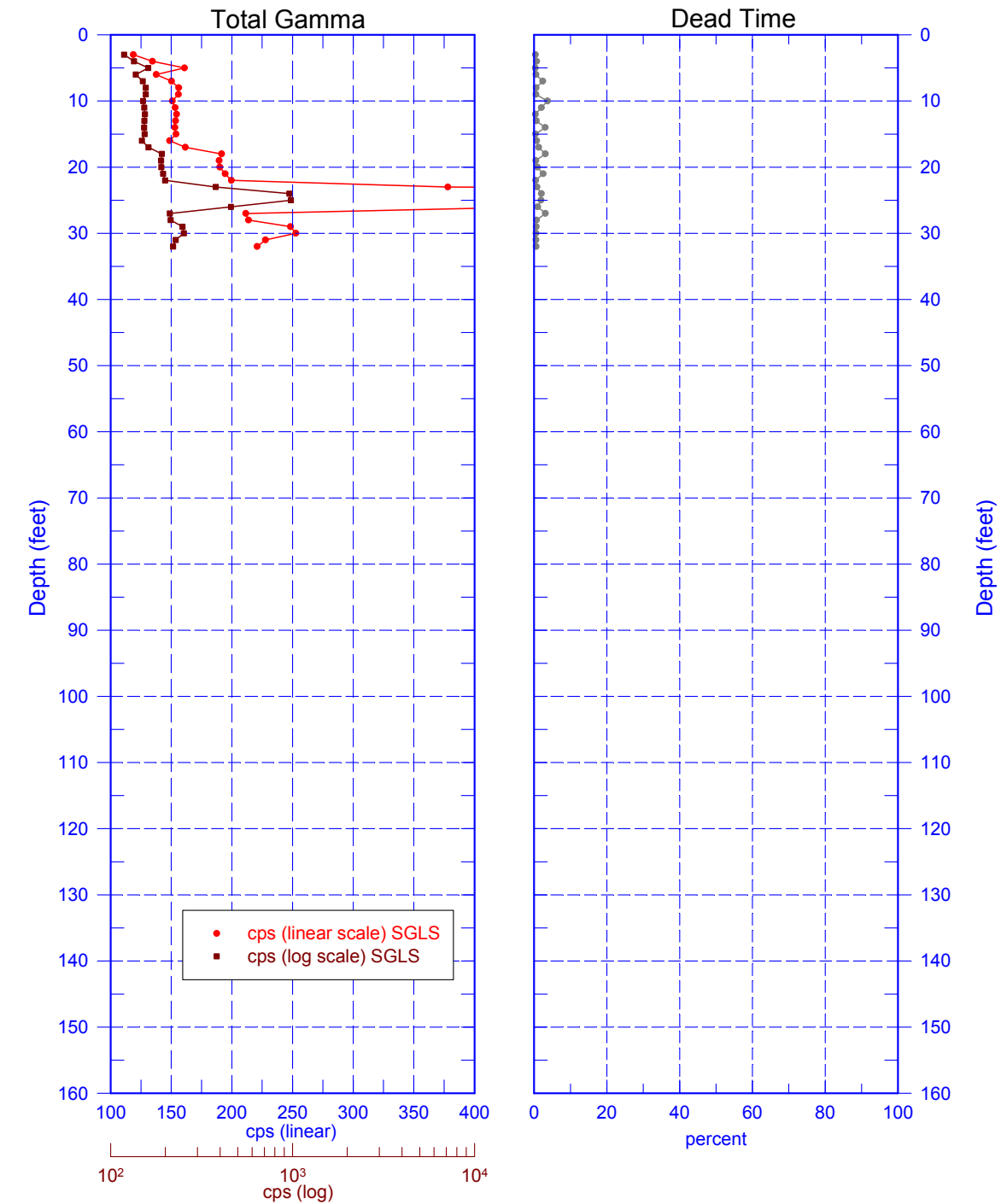
Zero Reference = Top of Casing

299-W18-184 (A7666) Combination Plot

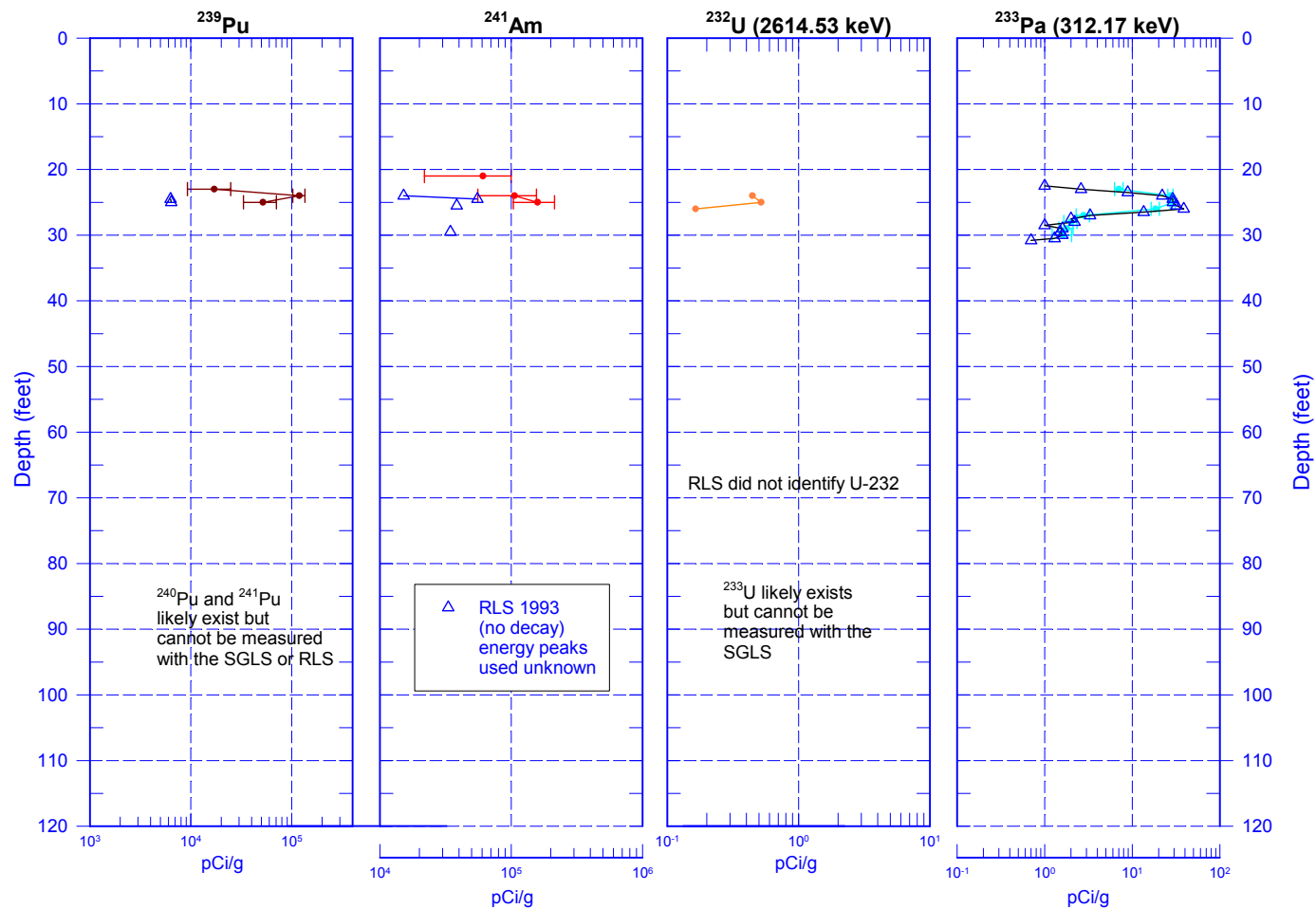


299-W18-184 (A7666)

Total Gamma & Dead Time

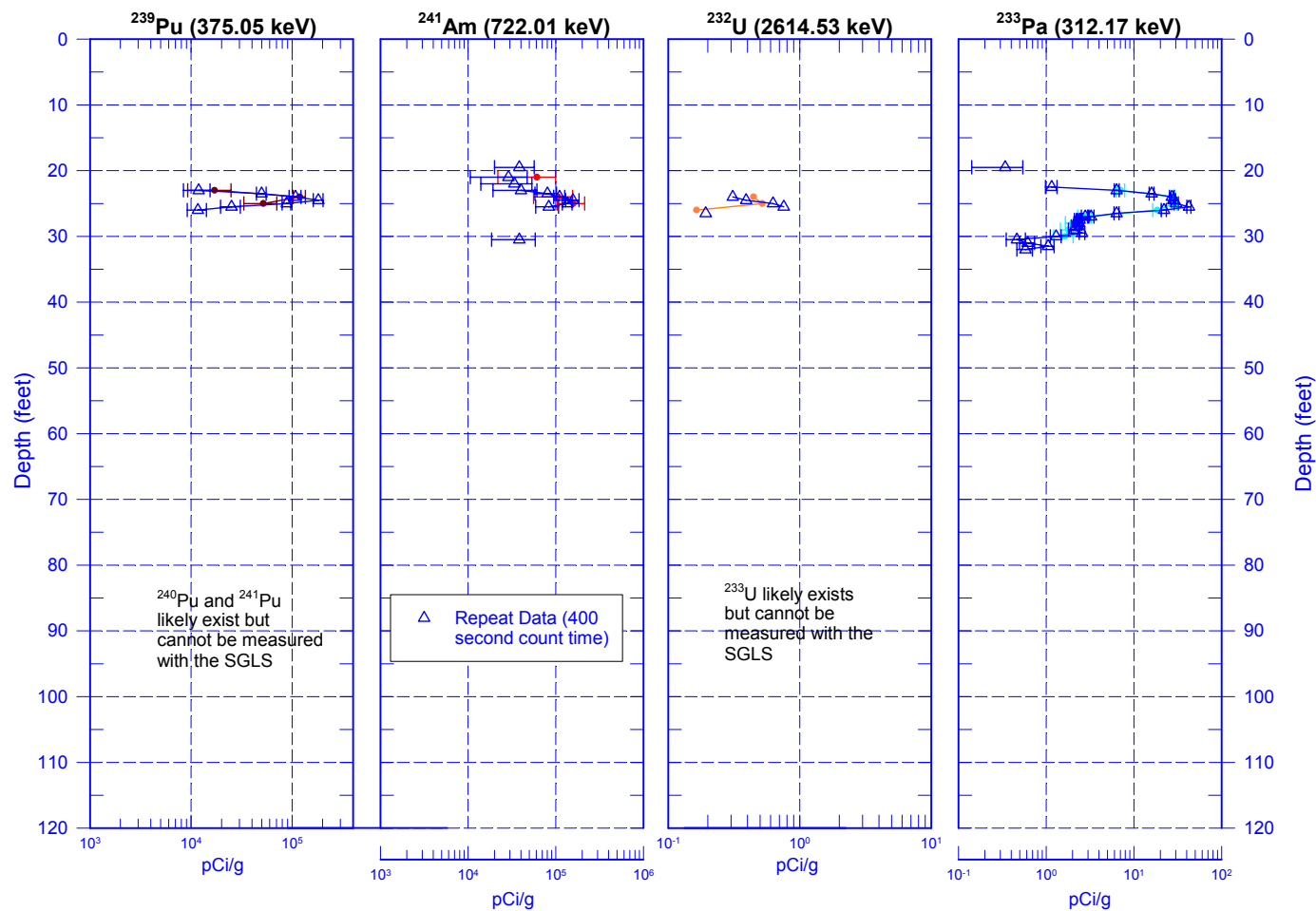


299-W18-184 (A7666) SGLS/RLS Comparison Plot



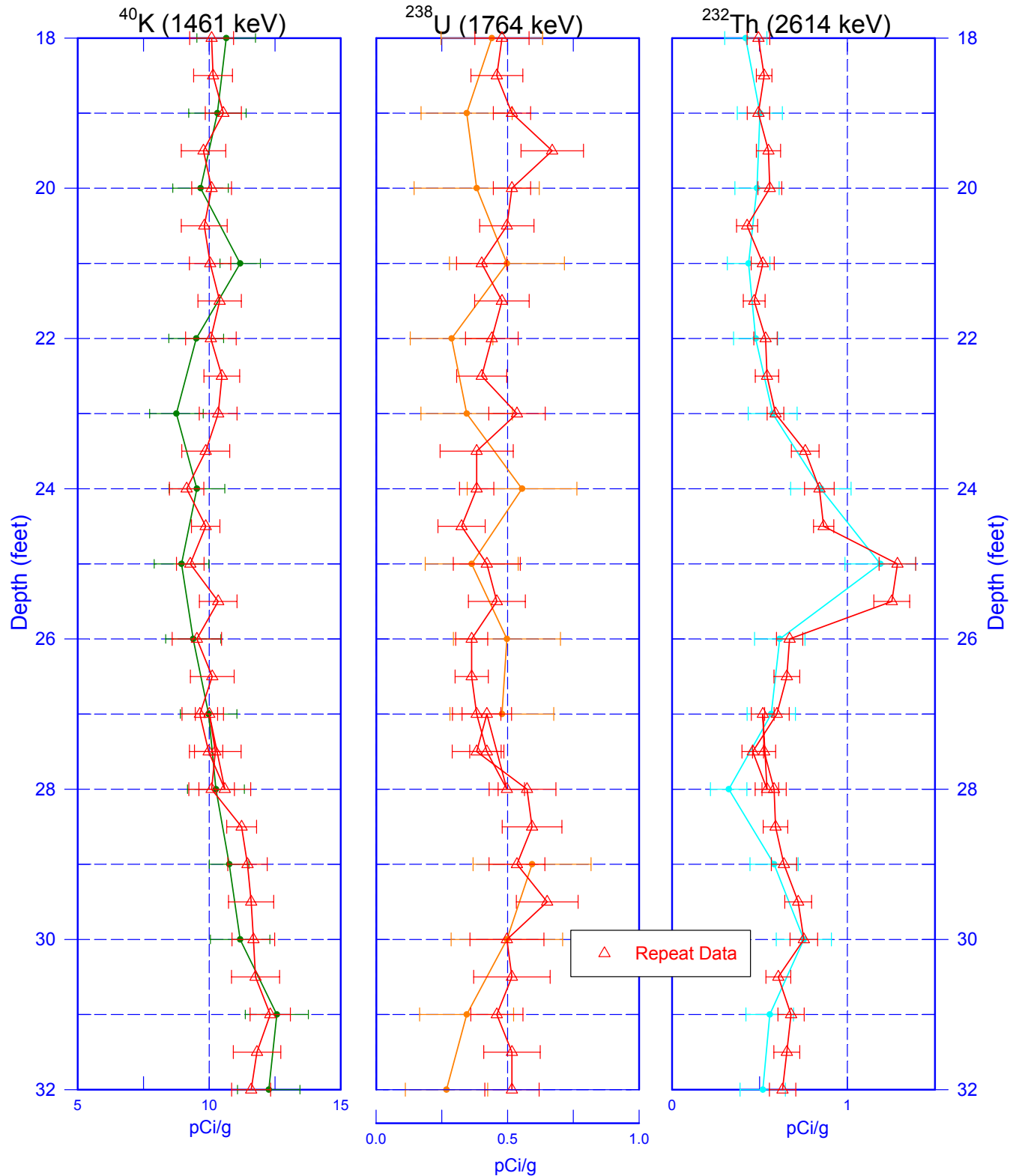
Zero Reference = Top of Casing

299-W18-184 (A7666) Repeat of Man-made Radionuclides



299-W18-184 (A7666)

Repeat Section of Natural Gamma Logs



Zero Reference = Top of Casing